



HM-99

**DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590**

21989

[Docket No. HM-99; Amdts. Nos. 171-21,
173-76, 178-27]

**SPECIFICATIONS 3AX, 3AAX, AND 3T
CYLINDERS**

The purpose of this amendment to the Hazardous Materials Regulations is to amend §§ 171.7, 173.34, 173.301, 173.302 and 173.304, and to add a new section 178.45, DOT specification 3T, to provide for the shipment of certain gases in large cylinders or tubes mounted on a motor vehicle.

On April 4, 1972, the Hazardous Materials Regulations Board published a notice of proposed rulemaking, Docket No. HM-99; Notice No. 72-3 (37 FR 6747), which proposed this amendment. Interested persons were invited to give their views and several comments were received by the Board.

1. *Hydrogen chloride.* A commenter stated that the proposed regulations omitted the authorization for hydrogen chloride to be shipped in DOT-3T cylinders. This authorization was purposely omitted because the Board has not completed its evaluation of DOT-3T cylinders in hydrogen chloride service.

2. *Nonliquefied natural gas.* Another commenter requested that the regulations be amended to permit nonliquefied natural gas to be shipped in DOT-3AX, 3AAX, and 3T cylinders. The Board has not authorized nonliquefied natural gas to be shipped in these cylinders because it has not been demonstrated that impurities which may be present in the gas would not affect the structure of the particular steel used in the manufacture of these cylinders.

3. *Design criteria for cylinders.* The proposed regulations provide design criteria for cylinders of 1000 pounds or more water capacity. A commenter has stated that this same design criteria should be applicable for cylinders of less than 1000 pounds water capacity and has requested that, wherever appropriate, the proposed regulations be amended to include the design criteria for the smaller water capacity cylinders. As this request is not within the scope of the present rule making, the Board did not address itself to the comment in this amendment.

4. *Cylinder attachment to vehicle.* Another commenter objected to the proposal which would require the rear end of the cylinders to be affixed to the vehicle. This commenter stated that adequate expansion provisions can be in-

corporated in the cylinders when they are affixed to the vehicle at the front end of the cylinders. The Board agrees that it need not specify rear end rigid attachment and has authorized the cylinders to be affixed at either end with thermal expansion provisions required at the opposite end.

5. *Editorial.* Section 178.45-11(d) is reworded to more clearly state the intent of the regulation. As previously worded, the words "the test may be repeated" did not clearly indicate the other option of reheat treatment and subsequent compliance with all the prescribed tests. Consequently, the objective of the use of the word "may" could be misunderstood.

Accordingly, 49 CFR Parts 171, 173, and 178 are amended to read as follows:

PART 171—GENERAL INFORMATION AND REGULATIONS

In § 171.7, paragraphs (c) (17), and (d) (12) are added to read as follows:

§ 171.7 Matter incorporated by reference.

(c) . . .

(17) Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(d) . . .

(12) U.S. Department of Commerce, National Bureau of Standards Handbook H28 (1957)—Part II is titled "Screw-Thread Standards for Federal Services 1957," December 1966 edition.

PART 173—SHIPPERS

§ 173.34 [Amended]

(A) In § 173.34 paragraph (e) table, the following is added as the ninth entry: "3T" . . . 5/3 times service pressure . . . 5."

(B) In § 173.301, paragraph (h) table is amended by adding as the fifth entry "DOT-3AX" and by adding the entry "DOT-3AAX" after 3AA in the first column; by adding the entry "DOT-3T" as the third entry in the second column; paragraph (d) (1) is amended and paragraph (1) is added to read as follows:

§ 173.301 General requirements for shipment of compressed gases in cylinders.

(d) . . .

(1) Manifolding is authorized for containers of the following gases: argon, air, carbon dioxide, helium, neon, nitrogen, nitrous oxide or oxygen provided that each container is individually equipped with safety relief devices as required by § 173.34 (d) or § 173.315 (1).

(1) Specifications 3AX, 3AAX, and 3T cylinders are authorized for transportation only when horizontally mounted on a motor vehicle and when valves and safety devices are protected, as follows:

(1) Each cylinder must be fixed at one

¹ Requirements covering cylinders are also applicable to spherical pressure vessels.

end of the vehicle with provision for thermal expansion at the opposite end attachment.

(2) The valve and safety relief device protective structure must be sufficiently strong to withstand a force equal to twice the weight involved with a safety factor of four, based on the ultimate strength of the material used; and

(3) Each discharge for a safety relief device on a cylinder containing a flammable gas must be upward and unobstructed.

(C) In § 173.302, paragraph (a) (3), the introductory text of paragraph (c), (c) (3) Table, and paragraph (f) are amended to read as follows:

§ 173.302 Charging of cylinders with non-liquefied compressed gases.

(a) . . .

(3) Specification 3AX, 3AAX, or 3T (§§ 178.36, 178.37, 178.45 of this subchapter) cylinders are authorized only for the following nonliquefied gases: air, argon, carbon monoxide, ethane, ethylene, helium, hydrogen, methane, neon, nitrogen, or oxygen, except that specification 3T is not authorized for hydrogen.

(c) *Special filling limits for Specifications 3A, 3AX, 3AA, 3AAX, and 3T cylinders.* Specifications 3A, 3AX, 3AA, 3AAX, and 3T (§§ 178.36, 178.37, 178.45 of this subchapter) cylinders may be

charged with compressed gases, other than liquefied, dissolved, poisonous, or flammable gases to a pressure 10 percent in excess of their marked service pressure, provided:

(3) . . .

Type of steel	Average wall stress limitation	Maximum wall stress limitation
(add) Steel of analysis and heat treatment specified in Spec. DOT-3T	87,000	94,000

(f) *Carbon monoxide.* Carbon monoxide must be shipped in a specification 3A, 3AX, 3AA, 3AAX, 3, 3E, or 3T (§§ 178.36, 178.37, 178.42, 178.45 of this subchapter) cylinder having a minimum service pressure of 1,800 p.s.i.g. The pressure in the cylinder must not exceed 1,000 p.s.i. at 70°F. except that if the gas is dry and sulfur free, a cylinder may be charged to five-sixths the cylinder service pressure or 2,000 p.s.i.g., whichever is the lesser.

(D) In § 173.304, paragraph (a) (2) Table is amended to read as follows:

§ 173.304 Charging of cylinders with liquefied compressed gas.

(a) . . .

(2) . . .

Kind of gas	Maximum permitted filling density (see Note 1)	Containers marked as shown in this column or of the same type with higher service pressure must be used except as provided in § 173.34(a), (b), § 173.301(f) (see notes following table)
(change) Carbon dioxide, liquefied (see Notes 4, 7, and 8).	Percent 68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39.
Carbon dioxide-nitrous oxide mixture (see Notes 7 and 8).	68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3ET2000; DOT-39.
Ethane (see Notes 8 and 9).	35.8	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-39.
Ethane (see Notes 8 and 9).	36.8	DOT-3A2000; DOT-3AX2000; DOT-3AA2000; DOT-3AAX2000; DOT-3T2000; DOT-39.
Ethylene (see Notes 8 and 9).	31.0	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-39.
Ethylene (see Notes 8 and 9).	32.5	DOT-3A2000; DOT-3AX2000; DOT-3AA2000; DOT-3AAX2000; DOT-3T2000; DOT-39.
Ethylene (see Notes 8 and 9).	35.5	DOT-3A2400; DOT-3AX2400; DOT-3AA2400; DOT-3AAX2400; DOT-3T2400; DOT-39.
Nitrous oxide (see Notes 7 and 8).	68	DOT-3A1800; DOT-3AX1800; DOT-3AA1800; DOT-3AAX1800; DOT-3; DOT-3E1800; DOT-3T1800; DOT-3HT2000; DOT-39.

PART 178—SHIPPING CONTAINER SPECIFICATIONS

(A) In the Table of Contents for Part 178, § 178.45 is added to read as follows:

Sec.	Specification 3T; seamless steel cylinder.
178.45	Compliance.
178.45-1	Type, size, and service pressure.
178.45-2	Inspection by whom and where.
178.45-3	Duties of the inspector.
178.45-4	Material, steel.
178.45-5	Manufacture.
178.45-6	Wall thickness.
178.45-7	Heat treatment.
178.45-8	Openings.
178.45-9	Safety devices and protection for valves, safety devices, and other connections.

178.45-11 Hydrostatic test.
178.45-12 Ultrasonic examination.
178.45-13 Basic requirements for tension and Charpy impact tests.
178.45-14 Basic conditions for acceptable physical testing.
178.45-15 Acceptable physical test results.
178.45-16 Rejected cylinders.
178.45-17 Markings.
178.45-18 Inspector's report.

(B) Section 178.45 is added to read as follows:

§ 178.45 Specification 3T; seamless steel cylinder.

§ 178.45-1 Compliance.

Each cylinder must meet the applicable requirements of § 173.24 of this subchapter.

§ 178.45-2 Type, size, and service pressure.

(a) **Type.** Each cylinder must be of seamless construction with integrally formed heads concave to pressure at both ends. The inside head shape must be hemispherical, ellipsoidal in which the major axis is two times the minor axis, or a dished shape falling within these two limits. Permanent closures formed by spinning are prohibited.

(b) **Size.** The minimum water capacity is 1,000 pounds.

(c) **Service pressure.** The minimum service pressure is 1,800 p.s.i.

§ 178.45-3 Inspection by whom and where.

Inspection of each cylinder must be performed by a competent and disinterested inspector, acceptable to the Bureau of Explosives. Chemical analyses and tests must be performed within the limits of the United States.

§ 178.45-4 Duties of the inspector.

(a) The inspector must determine that all materials are in compliance with the requirements of this specification.

(b) The inspector must verify compliance with the requirements of § 178.45-5 by making a chemical analysis or obtaining a certified chemical analysis from the material manufacturer for each heat of material. If an analysis is not provided by the material manufacturer, a sample from each heat must be analyzed.

(c) The inspector must determine that each cylinder is made and marked in compliance with this specification by:

- (1) Complete internal and external inspection;
- (2) Verification of proper heat treatment;
- (3) Selection of samples to be tested;
- (4) Witnessing all tests;
- (5) Verification of threads by gage; and
- (6) Preparation of required report.

§ 178.45-5 Material, steel.

(a) Only open hearth, basic oxygen, or electric furnace process steel of uniform quality is authorized. The steel analysis must conform to the following:

ANALYSES TOLERANCES

Element (percent)	Ladle analysis	Check analysis	
		Under	Over
Carbon.....	0.35 to 0.50.....	0.03	0.04
Manganese.....	0.75 to 1.05.....	0.04	0.04
Phosphorus (max).....	0.035.....		0.01
Sulfur (max).....	0.04.....		0.01
Silicon.....	0.15 to 0.35.....	0.02	0.03
Chromium.....	0.80 to 1.15.....	0.05	0.05
Molybdenum.....	0.15 to 0.25.....	0.02	0.02

(b) A heat of steel made under these specifications, the ladle analysis of which is slightly out of the specified range, is acceptable if satisfactory in all other aspects. However, the check analysis

tolerances shown in the above table may not be exceeded except as approved by the Department.

(c) Material with seams, cracks, laminations, or other injurious defects is not permitted.

(d) Material used must be identified by any suitable method.

§ 178.45-6 Manufacture.

(a) General manufacturing requirements are as follows:

(1) Dirt and scale must be removed prior to inspection and processing.

(2) Surface finish must be uniform and reasonably smooth.

(3) Inside surfaces must be clean, dry, and free of loose particles.

(4) No defect of any kind is permitted if it is likely to weaken a finished cylinder.

(b) If the cylinder surface is not originally free from the defects described in paragraph (a) of this section, the surface may be machined or otherwise treated to eliminate these defects provided the minimum wall thickness is maintained.

(c) Welding or brazing on a cylinder is not permitted.

§ 178.45-7 Wall thickness.

(a) The minimum wall thickness must be such that the wall stress at the minimum specified test pressure does not exceed 67 percent of the minimum tensile strength of the steel as determined by the physical tests required in §§ 178.45-14 and 178.45-15. A wall stress of more than 90,500 p.s.i. is not permitted. The minimum wall thickness for any cylinder may not be less than 0.225 inch.

(b) Calculation of the stress for cylinders must be made by the following formula:

$$S = \frac{P(1.3D^2 + 0.4d^2)}{D^2 - d^2}$$

where:

S=Wall stress in pounds per square inch;

P=Minimum test pressure, at least 5/3 service pressure;

D=Outside diameter in inches;

d=Inside diameter in inches.

(c) Each cylinder must meet the following additional requirements which assumes a cylinder horizontally supported at its two ends and uniformly loaded over its entire length. This load consists of the weight per inch of length of the straight cylindrical portion filled with water compressed to the specified test pressure. The wall thickness must be increased when necessary to meet this additional requirement.

(1) The sum of two times the maximum tensile stress in the bottom fibers due to bending (see paragraph (c) (1) (i) of this section), plus the maximum tensile stress in the same fibers due to hydrostatic testing (see paragraph (c) (1) (ii) of this section) may not exceed 80 percent of the minimum yield strength of the steel at this maximum stress.

(i) The following formula must be

used to calculate the maximum tensile stress due to bending:

$$S = \frac{Mc}{I}$$

where:

S=Tensile stress in pounds per square inch;

M=Bending moment in inch-pounds ($\frac{w l^3}{8}$);

I=Moment of inertia=0.04909 (D⁴-d⁴) in inches fourth;

c=Radius ($\frac{D}{2}$) of cylinder in inches;

w=Weight per inch of cylinder filled with water;

l=Length of cylinder in inches;

D=Outside diameter in inches;

d=Inside diameter in inches.

(ii) The following formula must be used to calculate the maximum longitudinal tensile stress due to hydrostatic test pressure:

$$S = \frac{A_1 P}{A_2}$$

where:

S=Tensile stress in pounds per square inch;

A₁=Internal area in cross section of cylinder in square inches;

P=Hydrostatic test pressure in pounds per square inch;

A₂=Area of metal in cross section of cylinder in square inches.

§ 178.45-8 Heat treatment.

(a) Each completed cylinder must be uniformly and properly heat treated prior to testing, as follows:

(1) Each cylinder must be heated and held at the proper temperature for at least one hour per inch of thickness based on the maximum thickness of the cylinder and then quenched in a suitable liquid medium having a cooling rate not in excess of 80 per cent of water. The steel temperature on quenching must be that recommended for the steel analysis, but it must never exceed 1750°F.

(2) After quenching, each cylinder must be reheated to a temperature below the transformation range but not less than 1050°F., and must be held at this temperature for at least one hour per inch of thickness based on the maximum thickness of the cylinder. Each cylinder must then be cooled under conditions recommended for the steel.

§ 178.45-9 Openings.

(a) Openings are permitted on heads only.

(b) The size of any centered opening in a head may not exceed one half the outside diameter of the cylinder.

(c) Openings in a head must have ligaments between openings of at least three times the average of their hole diameter. No off-center opening may exceed 2.625 inches in diameter.

(d) All openings must be circular.

(e) All openings must be threaded. Threads must be in compliance with the following:

(1) Each thread must be clean cut, even, without any checks, and to gage.

(2) Taper threads, when used, must be the American Standard Pipe thread (NPT) type and must be in compliance with the requirements of NBS Handbook H-28, Part II, Section VII.

(3) Taper threads conforming to National Gas Taper thread (NGT) standards must be in compliance with the requirements of NBS Handbook H-28, Part II, Sections VII and IX.

(4) Straight threads conforming with National Gas Straight thread (NGS) standards are authorized. These threads must be in compliance with the requirements of NBS Handbook H-28, Part II, Sections VII and IX.

§ 178.45-10 Safety devices and protection for valves, safety devices, and other connections.

Safety devices and protection arrangements for valves, safety devices, and other connections must be in compliance with § 173.34(d) of this subchapter. See also § 173.301(L) of this subchapter.

§ 178.45-11 Hydrostatic test.

(a) Each cylinder must be tested at an internal pressure by the water jacket method or other suitable method. The testing apparatus must be operated in a manner that will obtain accurate data. Any pressure gage used must permit reading to an accuracy of one percent. Any expansion gage used must permit reading of the total expansion to an accuracy of one percent.

(b) Any internal pressure applied to the cylinder after heat treatment and before the official test may not exceed 90 percent of the test pressure.

(c) The pressure must be maintained sufficiently long to assure complete expansion of the cylinder. In no case may the pressure be held less than 30 seconds.

(d) If, due to failure of the test apparatus, the required test pressure cannot be maintained, the test must be repeated at a pressure increased by 10 percent or 100 p.s.i., whichever is lower or, the cylinder must be reheated.

(e) Permanent volumetric expansion of the cylinder may not exceed 10 percent of its total volumetric expansion at the required test pressure.

(f) Each cylinder must be tested to at least 5/3 times its service pressure.

§ 178.45-12 Ultrasonic examination.

After the hydrostatic test, the cylindrical section of each vessel must be examined in accordance with ASTM Standard A-388-67 using the angle beam technique. The equipment used must be calibrated to detect a notch equal to five percent of the design minimum wall thickness. Any discontinuity indication greater than that produced by the five percent notch shall be cause for rejection of the cylinder unless the discontinuity is repaired within the requirements of this specification.

§ 178.45-13 Basic requirements for tension and Charpy impact tests.

(a) When the cylinders are heat treated in a batch furnace, two tension specimens and three Charpy impact specimens must be tested from one of the cylinders or a test ring from each batch. The lot size represented by these tests may not exceed 200 cylinders.

(b) When the cylinders are heat treated in a continuous furnace, two tension specimens and three Charpy impact specimens must be tested from one of the cylinders or a test ring from each four hours or less of production. However, in no case may a test lot based on this production period exceed 200 cylinders.

(c) Each specimen for the tension and Charpy impact tests must be taken from the side wall of a cylinder or from a ring which has been heat treated with the finished cylinders of which the specimens must be representative. The axis of the specimens must be parallel to the axis of the cylinder. Each cylinder or ring specimen for test must be of the same diameter, thickness, and metal as the finished cylinders they represent. A test ring must be at least 24 inches long with ends covered during the heat treatment process so as to simulate the heat treatment process of the finished cylinders it represents.

(d) A test cylinder or test ring need represent only one of the heats in a furnace batch provided the other heats in the batch have previously been tested and have passed the tests and that such tests do not represent more than 200 cylinders from any one heat.

(e) The test results must conform to the requirements specified in §§ 178.45-14 and 178.45-15.

(f) When the test results do not conform to the requirements specified, the cylinders represented by the tests may be reheated and the tests repeated. Paragraph (e) of this section applies to any retesting.

§ 178.45-14 Basic conditions for acceptable physical testing.

(a) The following criteria must be followed to obtain acceptable physical test results:

(1) Each tension specimen must have a gage length of two inches with a width not exceeding one and one-half inches. Except for the grip ends, the specimen may not be flattened. The grip ends may be flattened to within one inch of each end of the reduced section.

(2) A specimen may not be heated after heat treatment specified in § 178.45-8.

(3) The yield strength in tension must be the stress corresponding to a permanent strain of 0.2 percent of the gage length.

(i) This yield strength must be determined by the "offset" method or the "extension under load" method described in ASTM Standard E8-69.

(ii) For the "extension under load" method, the total strain (or, extension under load) corresponding to the stress at which the 0.2 percent permanent strain occurs may be determined with sufficient accuracy by calculating the elastic extension of the gage length under appropriate load and adding thereto 0.2 percent of the gage length. Elastic extension calculations must be based on an elastic modulus of 30,000,000. However, when the degree of accuracy of this method is questionable the entire stress-strain diagram must be plotted

and the yield strength determined from the 0.2 percent offset.

(iii) For the purpose of strain measurement, the initial strain must be set with the specimen under a stress of 12,000 p.s.i. and the strain indicator reading set at the calculated corresponding strain.

(iv) The cross-head speed of the testing machine may not exceed 1/4 inch per minute during the determination of yield strength.

(4) Each impact specimen must be Charpy V-notch type size 10 mm x 10 mm taken in accordance with paragraph 11 of ASTM Standard A-333-67. When a reduced size specimen is used, it must be the largest size obtainable.

§ 178.45-15 Acceptable physical test results.

(a) Results of physical tests must conform to the following:

(1) The tensile strength may not exceed 155,000 p.s.i.

(2) The elongation must be at least 16 percent for a two-inch gage length.

(3) The Charpy V-notch impact properties for the three impact specimens which must be tested at 0° F. may not be less than the values shown below:

Size of specimen (mm)	Average value for acceptance 3 specimens	Minimum value 1 specimen only of the three
10.0x10.0.....	25.0ft. lbs.....	20.0ft. lbs.
10.0x7.5.....	21.0ft. lbs.....	17.0ft. lbs.
10.0x5.0.....	17.0ft. lbs.....	14.0ft. lbs.

(4) After the final heat treatment, each vessel must be hardness tested on the cylindrical section. The tensile strength equivalent of the hardness number obtained may not be more than 165,000 p.s.i. (R' 36). When the result of a hardness test exceeds the maximum permitted, two or more retests may be made; however, the hardness number obtained in each retest may not exceed the maximum permitted.

§ 178.45-16 Rejected cylinders.

(a) Reheat treatment is authorized. However, each reheat treated cylinder must subsequently pass all the prescribed tests.

(b) Repair by welding is not authorized.

§ 178.45-17 Markings.

(a) Marking must be done by stamping into the metal of the cylinder. All markings must be legible and located on a shoulder.

(b) Required markings are as follows:

(1) "DOT-3T," followed by the service pressure (for example: "DOT-3T1800");

(2) The appropriate serial number;

(3) The registration number of the manufacturer ("M *****");

(4) The inspector's official mark near the serial number;

(5) The tare weight in pounds; and

(6) The date of the test (for example "5-72" for May 1972), so placed that dates of subsequent tests may be easily added.

(c) Markings must be at least 1/2 inch high.

(d) The markings prescribed by paragraphs (b) (1), (2), and (3) of this section must be displayed one immediately below the previous one as follows:

DOT-3T1800
1234
M 6789

(e) No person may mark any cylinder with the specification identification "DOT-3T" unless (1) it was manufactured in compliance with the requirements of this section and (2) its manufacturer has a registration number (M ****) from the Office of Hazardous Materials, Department of Transportation, Washington, D.C. 20590.

§ 178.45-18 Inspector's report.

(a) The inspector's report must be retained indefinitely by the manufacturer as long as DOT-3T cylinders are authorized for use by these regulations and a copy must be supplied the purchaser and owner of each cylinder. Upon sale by the original purchaser or owner, the seller must furnish the buyer a copy of the report. The manufacturer and owner must keep all reports available for examination upon request by representatives of the Department.

(b) Each report must be legible, and contain at least the following information:

INSPECTION REPORT COVERING THE MANUFACTURE OF SPECIFICATION DOT-3T CYLINDERS

The cylinders covered by this report were manufactured for _____ located at _____. They were manufactured by _____ located at _____. The cylinders are _____ inches in diameter (OD), _____ inches in length, and have a minimum wall thickness of _____ inches. The calculated stress is _____ p.s.i. under a test pressure of _____ p.s.i. The marks stamped into the shoulder of the cylinder are:

Specification DOT-_____;
Serial numbers _____ to _____ inclusive;
Inspector's mark _____;
DOT registration number M _____;
Tare weight _____;
Test date _____;
Other marks (if any) _____.

These cylinders were made by process of _____. The cylinders were heat treated by the process of _____. The metal used was identified by the following _____ numbers _____

(heat-purchase order)

The metal used was verified as to chemical analysis as shown in the "Record of Chemical Analysis of Metal" attached hereto. The heat numbers _____ marked on the metal _____ (were—were not)

All material was inspected visually and by ultrasonic means and all that was accepted was found free of injurious defects which might significantly affect the strength of the cylinder. The processes of manufacture and heat treatment of cylinders were observed and found satisfactory.

The cylinder walls and outside diameter were measured and the calculated stress for the cylinder design covered herein was verified.

Hydrostatic test, physical tests of the material, and other tests as prescribed in specification DOT-3T were made in the presence of the inspector. All materials, tests results, and cylinders accepted were found to be in compliance with the requirements of that specification and records therefor are attached hereto.

I hereby certify that all these cylinders proved satisfactory in every way and are in

compliance with the requirements of Department of Transportation Specification 3T.

Inspector's name _____ (Print)

Signed _____ (Inspector)

Inspector's Employer _____ Name & address _____

Place _____ Date _____

(Place) _____
(Date) _____

RECORD OF CHEMICAL ANALYSIS OF MATERIALS FOR CYLINDERS

Numbered _____ to _____ inclusive.
Size _____ inches outside diameter by _____ inches long
Made by _____ Company
For _____ Company

NOTE: Any omission of analyses by heats, if authorized, must be accounted for by notation hereon reading "The prescribed certificate of the manufacturer of material has been secured, found satisfactory, and placed on file." or by attaching a copy of the certificate.

Test No.	Heat No.	Check analysis No.	Cylinders represented (serial Nos.)	Chemical analysis						
				C	P	S	Si	Mn	Cr	Mo

The analyses were made by _____ (Signed) _____

Inspector's Name _____ (Print)

Inspector's employer _____ (Name & address) _____

(Place) _____
(Date) _____

RECORD OF PHYSICAL TESTS OF MATERIAL FOR CYLINDERS

Numbered _____ to _____ inclusive.
Size _____ inches outside diameter by _____ inches long
Made by _____ Company
For _____ Company

Test No.	Cylinders represented by test (serial nos.)	Yield strength at 0.2 percent offset (pounds per square inch)	Tensile strength (pounds per square inch)	Elongation (percent in 2 inches)	Reduction of area (percent)	Charpy V-notch	
						Average value for 3 specimens	Minimum value for one specimen

(Signed) _____

Inspector's name _____ (Print)

Inspector's employer _____ (Name & address) _____

(Place) _____
(Date) _____

RECORD OF HYDROSTATIC TESTS ON CYLINDERS

Numbered _____ to _____ inclusive.
Size _____ inches outside diameter by _____ inches long
Made by _____ Company
For _____ Company

¹ If the tests are made by a method involving the measurement of the amount of liquid forced into the cylinder by the test pressure, then the basic data, on which the calculations are made, such as the pump factors, temperature of liquid, coefficient of compressibility of liquid, etc., must also be given.

Inspector's employer -----
(Name & address)

(Sections 831-835 of Title 18, U.S.C.; sec. 9, Department of Transportation Act, 49 U.S.C. 1657)

D. H. CRIFTON,
*Captain; Alternate Board Member
for the United States Coast Guard.*

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